

Two Unknown Arboreal Frogs (genus *Platypelis*) Described from the Rainforests of Northeastern Madagascar (Microhylidae: Cophylinae)

FRANCO ANDREONE^{1*}, DANTÉ B. FENOLIO², AND MARK E. WALVOORD²

¹ *Museo Regionale di Scienze Naturali, Sezione di Zoologia, Via G. Giolitti, 36, I-10123 Torino, ITALY*

² *University of Oklahoma, Department of Zoology, 730 Van Vleet Oval, Richards Hall, Norman, Oklahoma, USA*

Abstract: Two new arboreal microhylid frogs are described from the rainforests of northeastern Madagascar. *Platypelis tetra* is a very small frog, reaching about 20 mm SVL, and inhabits phytotelms in screw *Pandanus* pines. It was found in some low and mid-altitude rainforests, such as Anjanaharibe-Sud, Besariaka, Tsararano, and Masoala Peninsula. This species diverges from the other *Platypelis* by its small size and colouration, with a series of whitish spots on the back, of which four are more evident. Furthermore, its advertisement call is composed by a long series of discrete notes at about 3.5–4 KHz of frequency, and a repetition rate of about 3.0 notes/s. The second species, *Platypelis mavomavo*, reaches a larger size (about 30 mm SVL), and is characterized by a yellowish colouration of the ventral surface, and a dorsal surface with a network of dark spots on a beige-yellow background. It is currently known from Anjanaharibe-Sud and Ambolokopatrika, around the Andapa water-basin, but is expected to have a wider distribution.

Key words: Amphibia; Anura; Microhylidae; *Platypelis*; New species; Madagascar

INTRODUCTION

Madagascar is well known for its biodiversity and high endemism (Glaw and Vences, 1994). Amphibians are no exception with more than 210 endemic species (Andreone and Luiselli, 2003) and many others still in wait for description. Like other vertebrates of Madagascar (e.g., fish and mammals, see Benstead et al., 2000; Yoder et al., 2003), the frogs of

this landmass belong to a few families, of which they represent an offshoot radiation. According to recent studies (Vences and Glaw, 2001) they are included in four families: Ranidae, Mantellidae, Microhylidae, and Hyperoliidae. Of these, the microhylids are still the most enigmatic clade, and their phylogenetic and taxonomic relations are largely unstudied. Of the three recognized Malagasy subfamilies (Dyscophinae, Scaphiophryninae, and Cophylinae), the cophylines account for a high number of species inhabiting rainforests and secondary altitude savannahs (Andreone, 1999). Indeed, little is known of their ecology and distribution

* Corresponding author. Tel: +39-011-4320-7310; Fax: +39-011-4323-331.

E-mail address: f.andreone@libero.it

except that they are specialized to a variety of microhabitats: e.g., the enigmatic *Rhombophryne testudo* and some *Plethodontohyla* species (such as *P. ocellata*, *P. alluaudi*, and *P. serratopalpebrosa*) are fossorial or terrestrial, the small *Stumpffia* are adapted to leaf-litter, and most of the *Anodonthyla*, *Platypelis*, *Cophyla*, and some *Plethodontohyla* are arboreal or semiarboreal. The conditions and evolutionary pressures that led to such a dramatic ecological radiation in these frogs are unknown. Further, whether an ecologically specialised group is indeed monophyletic is the subject of a separate work (Andreone et al., in press).

One reason for the lack of knowledge about cophyline microhylids is that they often lead a cryptic life, which makes their study difficult. In fact, many taxa are known from a few specimens and are only occasionally re-discovered (e.g., *Plethodontohyla coudreaui*; Andreone, in press a). This was confirmed by our own experience: during field surveys we often found specimens that could be grouped with one another representing the same ecological and morphological cluster, but were difficult to assign to any known taxon. This leads us to the idea that, especially in microhylids, many more species await description, and it is not an exaggeration to affirm that most likely the final number of species will stabilize around the double that currently known. Many of these specimens still await description and will be the object of further contributions, using both traditional (e.g., morphological analysis and comparisons of museum samples), and other methods (e.g., acoustics, karyology, DNA). While it is important to collect ecological and natural history information on unknown species, the discovery and rapid description of new frogs from Madagascar is important for two reasons: (1) it accelerates the cataloguing of the whole Malagasy batrachofauna, providing powerful tools to draw biogeographic relationships for conservation actions (see Andreone and Luiselli, 2003), and (2) it helps clarify the taxonomy and phylogeny of this subfamily in a region where

deforestation outpaces description. Written records and museum specimens might become all we have for future studies of the most sensitive species, which are rapidly vanishing.

The present paper is just a step in this direction and deals with the description of two new *Platypelis* that we found in northeastern Madagascar. One of these frogs is a *Pandanus*-specialized *Platypelis*, while the second is an arboreal generalist. They are sufficiently divergent from all known *Platypelis*, in both morphology and bioacoustics, to warrant description here.

MATERIALS AND METHODS

We searched for frogs during the night with the help of flashlights. Vocalizing males were located by following calls at sunset or during rainfall. One species described here is a microhabitat specialist, living within phytotelmata of screw-pines, *Pandanus* sp., and we spent daytime hours searching the leaf axils of these plants. After capture and photography of live colouration, specimens were sacrificed after anaesthesia in chlorobutanol, fixed in 4% formalin or 90% ethanol, and preserved in 70% ethanol. They are currently deposited in the Museo Regionale di Scienze Naturali, Torino (MRSN).

Measurements follow standard methods, using digital callipers or the dissecting microscope's micrometer (to the nearest 0.1 mm): SVL (snout-vent length), HW (head width), HL (head length, from the maxillary commissure to the snout tip), ED (horizontal eye diameter), END (eye-nostril distance), NSD (nostril-snout tip distance), NND (inter-narial distance), TD (horizontal tympanum diameter), HAL (hand length, from the carpal-metacarpal articulations to the tip of the longest finger), FORL (forelimb length, from the axilla to the tip of the longest finger), HIL (hindlimb length, from the cloaca to the tip of the longest toe), FOL (foot length, from the tarsal-metatarsal articulations to the tip of the longest toe), FOTL (foot length including tarsus, from the tibiotarsal articulation to the

tip of the longest toe), TIBL (tibia length).

When available, type specimens and/or other representative specimens of presumably related taxa from zoological collections were examined, as well as the original descriptions and subsequent works (e.g., Blommers-Schlösser and Blanc, 1991; Glaw and Vences, 1994). The advertisement calls were recorded with a SONY TC-D3 tape recorder with external microphone and analyzed with a VOXYS 3.1 sound system (Andreone et al., 2003). The proposed common names for the new species are provided in the authors' original languages (Italian and English) and in Malagasy.

Platypelis tetra sp. nov.

Four-spotted tree cophyline frog (English), cofilino degli alberi dalle quattro macchie (Italian), sahonkely anatihazo misy tebok'efatra (Malagasy).

Figs. 1–3

Type series

Holotype: MRSN A2174, adult male, Campsite W2, Anjanaharibe-Sud Massif, Analabe Valley, Befandriana Fivondronana, Mahajanga Faritany (Majunga Province), 14°46'S, 49°26'E, 1,250 m asl, collected by F. Andreone, H. Randriamahazo, and J. E. Randrianirina, 5 February 1996. Paratypes: MRSN A2171–2173, three adult females, same data as the holotype; MRSN A1952–1953, an adult male and an adult female, Tsararano Forest, Andatony Anivo, Andapa Fivondronana, Antsiranana Faritany (Diégo Suarez Province), 14°54.8'S, 49°42.6'E, 600 m asl, collected by F. Andreone and J. E. Randrianirina, 5 and 10 December 1996; MRSN A2175, one juvenile, Besariaka Forest, Andapa Fivondronana, Antsiranana Faritany (Diégo Suarez Province), between 14°49'S–14°50'S, 49°35'E–49°36'E, about 700 m asl, collected by J. E. Randrianirina, 1 May 1996; MRSN A646.1–4, three adult males and one juvenile, Masomihenjina Forest, Masoala Peninsula, Maroantsetra Fivondronana, Toamasina Faritany (Tamatave Province), 15°25'S, 49°46'E, collected by R. Nincheri, 24 July 1993; MRSN A2161,

A2164–2165, one juvenile and two adult males, Ambohidroina Forest, Masoala Peninsula, Mahalevona Fivondronana, Toamasina Faritany (Tamatave Province), 15°26.00'S, 49°57.56'E, 840 m asl, collected by J. E. Randrianirina, 26 January 2002; MRSN A2166, one juvenile, same date and collector, 28 January 2002; MRSN A2167, an adult male, same date and collector, 29 January 2002; MRSN A2169, one juvenile, same date and collector, 30 January 2002; MRSN A2170,

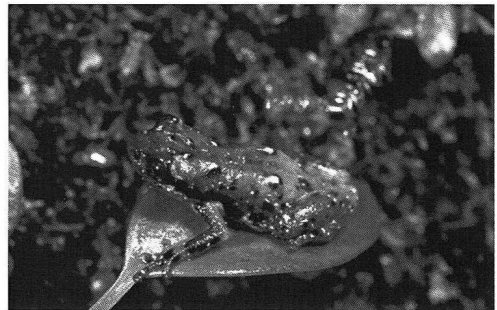


FIG. 1. *Platypelis tetra*. Holotype (male, MRSN A2174) from Analabe Valley, Anjanaharibe-Sud, western slope, NE Madagascar.

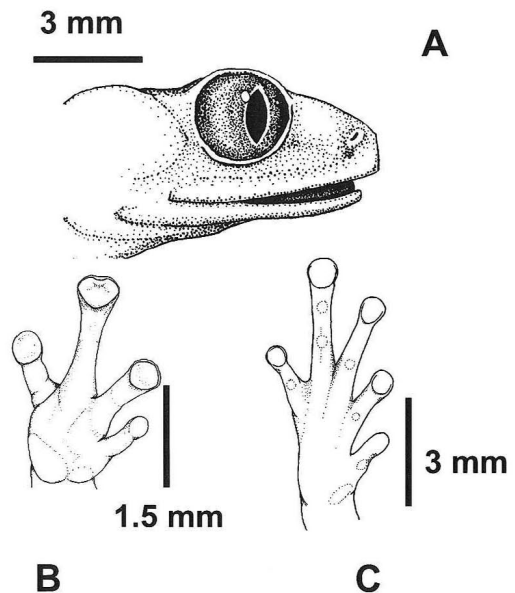


FIG. 2. Particular of the head (A), hand (B), and foot (C) of the holotype of *Platypelis tetra* (male, MRSN A2174).

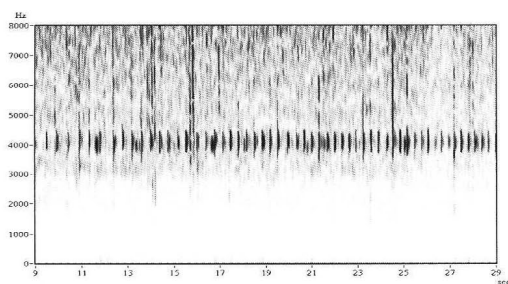


FIG. 3. Sonogram of part of a call (two notes out of a longer note series) of *Platypelis tetra*, recorded at Anjanaharibe-Sud, NE Madagascar. Recording temperature: 18C.

same date and collector, 9 February 2002.

Diagnosis

An arboreal *Platypelis* characterized by the following combination of characters: small adult body size, canthus rostralis indistinct, toe and finger pads more circular than ovoid and moderate in size; hands and feet without webbing, tarso-metatarsal articulation reaching the eye, dorsal surface smooth, dorsal colour shading from brown to tan, sometimes with irregular markings and at least four oblong white spots on the dorsal surface.

Description

The SVL in the examined males ranged from 15.7 to 18.2 mm. In the females from 17.5 to 19.4 mm. Other measurements of the type series are given in Table I. Head as long as wide; HW 32–41% of SVL; HL 31–41% SVL; snout short, slightly protruding beyond margin of lip; rounded and blunt in dorsal view and in profile; END less than ED; END 20–26% of HL; eye moderate in size; ED 28–36% of HL. Top of head flat; cranial crests absent; canthus rostralis indistinct; internarial area not depressed; nostril more circular than ovoid; protruding laterally. Weak supratympanic fold usually visible, tympanum round, TD 34–67% of ED. Choanae small, round, separated, partially obscured by palatal shelf of maxillary arch. Vomerine teeth present and posterior to choanae. Tongue trapezoid in shape with rounded edges, widest

at the free margin, no groove or notch, free behind for about two thirds of its length. Pupil horizontal. Vocal sac moderate in size, single, and in gular position. Skin on dorsum of head, body, belly, and limbs smooth. Fingers moderate in length bearing circular, moderately sized discs compared with phalanges; disc on first digit smaller than others: $1 < 2 < 4 < 3$; subarticular tubercles faint, circular, not elevated; supernumerary tubercles absent; palmar tubercle semi-distinct, not elevated. No webbing between fingers. Feet with semi-distinct supernumerary tubercles; vestiges of metatarsal tubercle; no other distinct tubercles. Small pads on toes, circular in shape. No webbing between toes. Toe length: $1 < 2 < 5 < 3 < 4$.

Coloration

After five-seven years of preservation in ethanol, all the specimens still show contrasting colouration. Dorsum of head, body, and limbs are brown or tan with vague darker markings, and legs have irregular tan spots. Four bigger dorsal whitish spots are present on the back (two just behind the head, and two other on the sacral bone). Other smaller scattered light points are also present on the back and superior parts of legs in some individuals. In some cases the four main spots form a sort of hourglass figure on the dorsum. Flanks with a brown dorsolateral band beginning posterior to the eye, passing through the union of the arms with the body and down each flank, ending at the groin; brown bar is edged above and below by a thin cream line. The anterior surface of the arm with a brown line extending from the union of the arms with the body and terminating at or before the elbow. Iris brownish shading to copper, with peripheral fine spots and dark shadings. Ventral surface grey to creamish with a few brown flecks, sometimes forming dark spots.

Variation

The paratypes come from Anjanaharibe, Besariaka, Tsararano, and Masoala, spanning therefore about 200 km. These specimens agree with the holotype in colouration. The

TABLE 1. Morphometric measurements (in mm) of type specimens of *Platypelis tetra* sp. nov. and *P. mavomavo* sp. nov. M=male, F=female, J=juvenile, holotype marked with an asterisk. For abbreviations see the text.

Museum number	Provenience	Sex	SVL	HW	HL	ED	END	NSD	NND	TD	HAL	FORL	FOL	TIBL
<i>Platypelis tetra</i>														
MRSN A2174*	Anjanaharibe-Sud	M	17.5	6.4	6.2	2.0	1.3	1.6	2.0	0.8	3.2	5.9	6.0	17.5
MRSN A2172	Anjanaharibe-Sud	M	18.2	6.5	6.3	2.2	1.4	1.6	2.1	1.2	3.4	6.5	5.4	18.2
MRSN A1952	Tsararano	M	16.5	5.9	5.8	1.9	1.3	1.5	2.0	0.9	2.8	6.6	4.5	16.5
MRSN A646.1	Masomihenjina	M	15.8	5.5	5.7	1.9	1.4	1.4	2.0	0.9	3.1	6.4	5.3	15.8
MRSN A646.2	Masomihenjina	M	15.7	6.2	6.1	2.1	1.2	1.4	2.0	1.0	3.4	6.4	5.2	15.7
MRSN A646.3	Masomihenjina	M	16.2	5.2	5.8	1.8	1.5	1.5	2.1	1.1	2.8	5.9	4.6	16.2
MRSN A2164	Ambohidroina	M	18.2	6.2	6.3	2.2	1.5	1.7	2.0	0.9	3.4	6.6	5.4	18.2
MRSN A2165	Ambohidroina	M	18.2	6.8	6.3	1.8	1.4	1.9	2.2	1.2	3.7	7.3	5.7	18.2
MRSN A2167	Ambohidroina	M	15.9	5.7	5.5	1.7	1.4	1.5	2.2	1.1	2.9	6.5	4.5	15.9
MRSN A2170	Ambohidroina	M	16.6	5.9	5.7	2.0	1.4	1.7	2.1	1.0	2.8	6.7	5.5	16.6
MRSN A2173	Anjanaharibe-Sud	F	19.4	6.8	7.1	2.3	1.5	1.6	2.1	0.8	3.8	6.3	5.9	19.4
MRSN A2171	Anjanaharibe-Sud	F	18.9	6.9	6.4	2.3	1.5	1.9	2.2	1.2	4.1	7.6	5.7	18.9
MRSN A1953	Tsararano	F	17.5	5.8	6.3	2.0	1.3	1.8	2.1	1.0	2.8	6.8	5.1	17.5
MRSN A2175	Besariaka	J	13.1	5.3	5.3	1.9	1.1	1.3	1.8	1.0	2.9	6.5	4.9	13.1
MRSN A646.4	Masomihenjina	J	11.5	4.5	4.7	1.5	1.1	1.3	1.7	0.7	2.1	4.1	3.9	11.5
MRSN A2161	Ambohidroina	J	14.3	5.2	5.4	1.9	1.3	1.3	1.7	0.7	3.1	6.5	4.3	14.7
MRSN A2166	Ambohidroina	J	14.9	5.3	5.5	2.0	1.4	1.3	1.8	0.7	3.2	6.4	4.3	14.9
MRSN A2169	Ambohidroina	J	14.9	5.2	6.1	1.8	1.2	1.5	1.8	0.8	3.2	6.0	4.2	14.9
<i>Platypelis mavomavo</i>														
MRSN A2435*	Ambolokopatrika	M	26.5	9.3	9.7	4.1	2.5	2.1	3.0	1.7	8.1	18.8	12.4	26.5
MRSN A2432	Ambolokopatrika	M	28.6	11.3	9.6	3.6	2.5	2.4	2.7	1.7	8.6	20.7	12.6	28.6
MRSN A2434	Ambolokopatrika	M	24.4	8.4	8.5	2.9	2.5	2.1	2.6	2.1	8.8	17.5	10.7	24.4
MRSN A2431	Ambolokopatrika	F	27.9	9.9	9.7	4.0	2.4	2.6	3.2	1.8	8.5	18.3	12.8	27.9
MRSN A2433	Ambolokopatrika	F	26.8	9.4	8.8	3.4	2.0	2.4	3.6	1.6	8.1	19.4	11.7	26.8

individuals from Masomihenjina (Masoala) show a paler dorsal colouration, and a contrasted lateral band. Colouration in life was basically similar to that described for preserved animals, although much more vivid.

Etymology

The word “tetra” is derived from the Greek “tetras” means “four” and is attributed to the fact that most specimens show four lighter spots on the back. This name is used as a noun with the same meaning.

Natural history and distribution

The holotype and some of the paratypes were collected at Anjanaharibe-Sud, western slope (Analabe Forest), Campsite W2 (around 1200 m asl), where the habitat is comprised of a mid-high altitude transitional rainforest with tall trees and abundant lichens, mosses, and ferns (Raxworthy et al., 1998; Andreone et al., 2000). The specimens were found within a plant of the genus *Pandanus*. A single specimen was found at Besariaka Forest. This forest at about 60 km south of Andapa is rather degraded, especially in areas far from streams, due to cattle, cutting of trees by

villagers, and use of path systems. The specimen was found within a *Pandanus*, and did not call. Other paratypes came from Tsararano. The mountain chain and forest of the same name lie midway between the Anjanaharibe-Sud Massif and the Masoala Peninsula, and is formed by several hills. The forest was at that time (1996) mostly intact, perhaps due to its distance from large-sized villages. The remainder of specimens were found at Masoala at two low altitude sites (Masomihenjina and Ambohidroina), always within *Pandanus*. This species is evidently specialized to this plant, and is a phytotelm frequenter (Lehtinen, 2003). Concerning the distribution, *P. tetra* was until now found only in the northeastern sector of Madagascar, an area which is interesting in terms of endemism and species diversity (Andreone, in press b). We do not have evidence of a wider distribution, although we strongly suspect that its presence runs southward, and possibly, northwards.

Advertisement calls

Calls were recorded on 5 February 1996 between 1830 and 1900 h, at an air temperature of 18.0–18.5°C. They consisted of an almost endless series of chirping metallic notes. Temporal call parameters were: note duration 171–318 ms ($\bar{x} \pm SD = 266 \pm 41$ ms, $N=17$), duration of inter-note intervals 148–398 ms (226 ± 59 ms, $N=13$), note repetition rate 3.0/s. The frequency showed a simple pattern, with a dominant frequency between 3500–4000 Hz.

Comparisons with other species

Of the other *Platypelis* species possibly sympatric and similarly sized, *P. tetra* differs: (1) from *P. barbouri* in lacking webbing between the toes and fingers, in lacking the red or green markings on the dorsal surface of the groin and thighs, in the presence of white dorsal spots, and of a brown dorsolateral bar bordered in cream; (2) from *P. cowani* in lacking webbing between the toes, in the absence of a beige triangular marking on the

dorsal surface, in the possession of white dorsal spots, and brown dorsolateral bars; (3) from *P. occultans* in lacking webbing between the toes, a triangular marking on the back, in a tibio-tarsal articulation extending to the eye, in the possession of dorsal spots, and in the presence of the dorsolateral bands. Within the wealth of *Platypelis* species, *P. tetra* is morphologically similar to *P. tuberifera*, although the latter reaches a larger size (up to 40 mm). *Platypelis tetra* could be misidentified with juveniles of this species, from which it differs in lacking toe webbing, the absence of a dorsal median line, the possession of white dorsal spots, and in the possession of a brown dorsolateral bar bordered in cream.

Platypelis mavomavo sp. nov.

Yellowish tree cophyline frog (English),
cofilino arboreo giallastro (Italian), sahonkely
mavomavo (Malagasy)

Figs. 4–6

Type series

Holotype. MRSN A2435, adult male, Ambolokopatrika, Antsinjorano, 14°32.6'S, 49°25.8'E, 975 m asl, Andapa Fivondronana, Antsiranana Faritany (Diégo Suarez Province), collected by F. Andreone, G. Aprea, and J. E. Randrianirina, 10 December 1997; Paratypes. MRSN A2433, an adult female, same data and collectors, 18 December 1997; MRSN A2431, adult female, Ambolokopatrika, Andemakatsara, 14°31.8'S, 49°26.5'E, 875 m asl, collected by F. Andreone and J. E. Randrianirina, 2 June 1997; MRSN A2432, adult male, Ambolokopatrika, Andranomadio, 14°32.4'S, 49°26.3'E, 890 m asl, collected by F. Andreone, G. Aprea, and J. E. Randrianirina, 1 December 1997; MRSN A2434, adult male (dissected for karyological analyses), Ambolokopatrika, Antsinjorano, collected by F. Andreone, G. Aprea, and J. E. Randrianirina, 1 December 1997.

Other specimens

Platypelis mavomavo was first discovered in January 1996 at Anjanaharibe-Sud, western



FIG. 4. *Platypelis mavomavo*. Holotype (male, MRSN A2435), dorsal view, from Ambolokopatrika, NE Madagascar.



FIG. 5. Particular of the head (A), hand (B), and foot (C) of the holotype of *Platypelis mavomavo* (male, MRSN A2435).

slope. The specimen discovered was photographed but not captured.

Diagnosis

An arboreal species of *Platypelis* characterized by the following combination of characters: medium adult body size (SVL=35 mm), yellowish colouration, with extended brownish marblings, digital expansions triangular in the fingers and ovoid on toes, vestigial webbing between the toes, dorsal surface from smooth to slightly warty.

Morphological description

The three males ranged in size from 24.4 to 28.6 mm; the two females were respectively 26.8 and 27.9 mm long. Other measurements of the type series are given in Table I. Head as long as wide; HW 34–40% of SVL; HL 33–35% SVL; snout short, slightly protruding

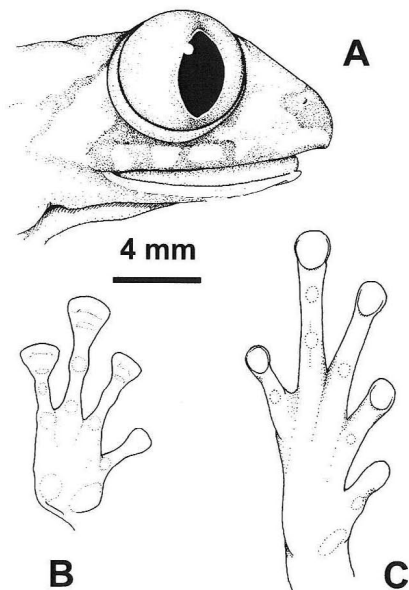


FIG. 6. *Platypelis mavomavo*. Holotype (MRSN A2435), ventral view.

beyond margin of lip; rounded in dorsal view (in profile, lightly truncated); END less than ED; END 23–30% of HL; eye moderate in size; ED 34–42% of HL. Top of head flat; cranial crests absent; canthus rostralis indistinct; internarial area not depressed; nostrils protruding dorsally and laterally. Supratympanic fold visible, tympanum round, TD 41–47% of ED. Choanae small, round, and separated. Vomerine teeth present and posterior to choanae. Tongue trapezoid in shape with rounded edges, widest at the free margin, with a slight frontal notch. Vocal sac moderate in size, single, and in gular position. Skin on dorsum of head, body, and limbs quite smooth, although in some specimens elongated warts are visible. Ventral surfaces smooth. Forearm broad, fingers moderate in length bearing subtriangular, large discs; disc on first digit smaller than others: $1 < 2 = 4 < 3$; subarticular tubercles faint, circular; supernumerary tubercles absent; palmar tubercle semi-distinct, not elevated. No webbing between digits of hands. Feet with semi-distinct supernumerary tubercles. Small pads on digits of feet, ovoid in shape. Vestigial webbing between third and

fourth, and between fourth and fifth toes. Toe length: $1 < 2 \leq 5 < 3 < 4$.

Coloration

After about six years in preservative solution, the dorsum of this new *Platypelis* has become light brownish, with scattered lighter spots and reticulations. The legs have approximately the same colouration as the back, with some pigmented transverse areas or spots. Most of the hands and feet are brown or black. Pupil horizontal, iris yellowish with dark spots. The ventral surface is cream/yellow with some faint dark marbling, more visible on the throat. In life, the colouration is similar in pattern, although more distinct. The yellow is conspicuous and bright in live animals (especially on the belly), but disappeared after preservation in formalin and/or ethanol.

Variation

The type series consists of four specimens from Ambolokopatrika, quite similar in morphology and size to the holotype.

Advertisement calls

Unknown.

Etymology

The specific name *mavomavo* (pronounce: "mow-woo mow-woo") is a Malagasy term: "mavo" means yellow, and the duplicate "mavomavo" adjective yellowish. It makes obvious reference to the typical species' colouration and is used as an invariable noun standing in apposition to the generic name.

Natural history and distribution

The type series was collected at Ambolokopatrika, where the habitat is a mid-high altitude transitional rainforest, with tall trees and an abundance of epiphytic plants. The specimens were found during rainy nights climbing well above the ground (about 2–4 m) on small tree trunks. A similar habitat was observed for one specimen (not captured) at Anjanaharibe-Sud. This species is apparently not a phytotelm specialist, although it is

likely that, similarly to other species (e.g., *P. pollicaris*) it may hide during the day and dry periods in trunk-holes, under barks, and at the basis of epiphytic plants. Given its presence at Ambolokopatrika and Anjanaharibe-Sud, we expect the species' distribution to include other areas of northeastern Madagascar.

Comparisons with other species

Platypelis mavomavo is most similar to *Platypelis cowani* and *P. pollicaris*. They are different from *P. mavomavo* especially in colouration. In particular, both have a brown dorsum, with light spots, and their belly is typically white. *Platypelis tsaratananaensis* (at least the specimens from Anjanaharibe-Sud) has a more slender body, and it hides in bamboo internodes.

DISCUSSION

The discovery of the new *Platypelis* species described herein, at some localities of northeastern Madagascar highlights the incomplete knowledge of the microhylid fauna of Madagascar. *Platypelis tetra* is likely the smallest arboreal frog of Madagascar, reaching a SVL of only 18 mm. It is smaller than *P. barbouri* (23 mm), *Anodonthyla boulengeri* (23 mm), and *A. nigrigularis* (24 mm) (records from Glaw and Vences, 1994). This small size coupled with sticky skin and toe pad shape makes *Platypelis tetra* a good climber of the leaves beneath which it lives. At Anjanaharibe-Sud we found *Platypelis tetra* in syntopy with another *Platypelis* of small size (*P. occultans*), *P. tuberifera*, *Mantidactylus* cf. *bicalcaratus* and *M. pulcher*.

Platypelis tetra lives in close relationship with the *Pandanus* microhabitat, and, therefore, needs a pristine or mature secondary rainforest. *Platypelis mavomavo* was found only at some intact forest fragments of Anjanaharibe-Sud and Ambolokopatrika forests. In this sense, both these cophylines are both closely tied to the existence of an intact rainforest and to high humidity levels. For these reasons they are good candidates for being

ecologically sensitive species, as stressed by Vallan (2000) and Andreone and Luiselli (2003).

Given the increasing deforestation occurring in the Andapa water basin (Berner, 1995), the protection of the remnant forest fragments corresponds to the protection of the *Pandanus* screw pines where *P. tetra* and other frogs live. The sites where the new species were found are either partly included in a reserve network or are in places where logging is still conducted at a low rate. As outlined by Vallan et al. (in press) this kind of forest exploitation does not have an immediate negative effect on the batrachofauna. The long-term effects are still largely unknown, but it is obvious that the physical reduction of the rainforest will coincide with the disappearance of many frog species.

ACKNOWLEDGEMENTS

We thank G. Aprea, H. Randriamahazo and J. E. Randrianirina for field assistance, and the Malagasy authorities for collection and export permits. R. Nincheri helped with material, photographs and personal observations. P. Bergò and V. Mercurio assisted with the specimens' setting. The research of FA was made in cooperation between the MRSN, and the Parc Botanique et Zoologique de Tsimbazaza, Antananarivo, and supported by WWF, MRSN, and WCS. Further support to DF and MEW was provided by "Radeau des Cimes", the Oklahoma City Zoo and Zoological Society, P. Stout, the University of Oklahoma Department of Zoology, B. and H. Fenolio, G. and B. Walvoord, and K. Walvoord. Equipment and other support was provided by the Sam Noble Oklahoma Museum of Natural History, A. Estep, C. Leary, M. Mandica, M. Hoefnagels, V. Hutchison, and J. Caldwell. Special thanks to our climbing technician in Madagascar, N. Baiben. M. Matsui and an anonymous referee reviewed a first version of this paper.

LITERATURE CITED

- ANDREONE, F. 1999. Chapter 6. Madagascan amphibians. p. 213–261. *In*: S. Yamagishi (ed.), *Madagasukaru no Dobutsu* [The Animals of Madagascar—Its wonderful adaptive radiation]. Shoukabo, Tokyo. (in Japanese)
- ANDREONE, F. In press a. Geographic distribution. *Plethodontohyla coudreauui*. Herpetol. Rev.
- ANDREONE, F. In press b. Crossroad of herpetological diversity: survey work for an integrated conservation of the amphibian and reptile fauna in Northern Madagascar. *Ital. J. Zool.*
- ANDREONE, F., G. APREA, M. VENCES, AND G. ODIERNA. 2003. A new frog of the genus *Mantidactylus* from the rainforests of north-eastern Madagascar, and its karyological affinities. *Amphibia-Reptilia* 24: 285–303.
- ANDREONE, F. AND L. M. LUISELLI. 2003. Conservation priorities and potential threats influencing the hyper-diverse amphibians of Madagascar. *Ital. J. Zool.* 70: 53–63.
- ANDREONE, F., M. VENCES, D. R. VIEITES, F. GLAW, AND A. MEYER. In press. Recurrent ecological adaptations revealed through a molecular analysis of the secretive cophyline frogs of Madagascar. *Mol. Phyl. Evol.*
- BENSTEAD, J. P., M. L. J. STIASSNY, P. V. LOISELLE, K. J. RISENG, AND N. RAMINOSOA. 2000. River conservation in Madagascar. p. 205–231. *In*: P. J. Boon, B. R. Davies and G. E. Petts (eds.), *Global Perspectives of River Conservation: Science, Policy and Practice*. John Wiley and Sons, Chichester.
- BERNER, P. O. 1995. Préparation d'un volet forestier d'un projet de conservation et développement intégré de la région est de Madagascar: le cas du complexe des réserves de Marojejy et d'Anjanaharibe-Sud. *Akon'ny Ala* 17: 28–39.
- BLOMMERS-SCHLÖSSER, R. M. A., AND C. P. BLANC. 1991. Amphibiens (première partie). *Faune de Madagascar* 75(1): 1–379.
- GLAW, F. AND M. VENCES. 1994. A Fieldguide to the Amphibians and Reptiles of Madagascar, 2nd Edition. Vences und Glaw Verlag, Köln.
- LEHTINEN, R. M. 2003. The use of screw pines (*Pandanus* spp.) by amphibians and reptiles in Madagascar. *Herpetol. Bull.* 82: 20–25.

- RAXWORTHY, C. J., F. ANDREONE, R. A. NUSSBAUM, N. RABIBISOA, AND H. RANDRIAMAHAZO. 1998. Amphibians and reptiles of the Anjanaharibe-Sud Massif, Madagascar: Elevational distribution and regional endemism. p. 79–92. *In*: S. M. Goodman (ed.), A Floral and Faunal Inventory of the Eastern Slopes of the Réserve Spéciale d'Anjanaharibe-Sud, Madagascar, with Reference to Elevational Variation. Fieldiana Zoology (n.s.) 90, Field Museum of Natural History, Chicago.
- VALLAN, D. 2000. Influence of forest fragmentation on amphibian diversity in the nature reserve of Ambohitantely, highland Madagascar. *Biol. Conserv.* 96: 31–43.
- VALLAN, D., F. ANDREONE, V. H. RAHERISOA, AND R. DOLCH, in press. Consequences of low, selective wood exploitation on Amphibians in the tropical rain forest of An'ala in East Madagascar. *Oryx*.
- VENCES, M. AND F. GLAW. 2001. When molecules claim for taxonomic change: New proposals on the classification of Old World treefrogs. *Spixiana* 24: 85–92.
- YODER, A. D., M. M. BURNS, S. ZEHR, T. DELEFOSSE, G. VERON, S. M. GOODMAN, AND J. J. FLYNN. 2003. Single origin of Malagasy Carnivora from an African ancestor. *Nature* 421: 734–737.

Accepted: 11 December 2003